

# NASA TECH BRIEF



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## Self-shielding Printed Circuit Boards for High Frequency Amplifiers and Transmitters

### The problem:

Construct compact, lightweight, efficient high frequency amplifiers and transmitters with multiple stages kept isolated from each other, both thermally and electrically, and with oscillation prevented and spurious output signals reduced.

### The solution:

Use printed circuit boards with as much copper left on them as possible for electromagnetic shielding between stages of the high frequency amplifiers and transmitters. In addition, keep all RF lead lengths to a very short minimum on these boards to improve circuit efficiency.

### How it's done:

The printed circuit boards themselves are used as shields between the various circuits.

When laying out the boards, which are 5.14''  $\times$  1.98'' cards that mate with the 5''  $\times$  5'' vertical member in each plug, care is taken to keep all printed lines on one side (component side) of the board. The paths of ground current of the stage are isolated as much as possible to reduce magnetic coupling between inductors and to keep lead lengths as short as possible.

Enough copper is etched away around printed wires and terminals to make the necessary connections, but the remainder of the copper (about 80-90 percent on the reverse side of the board and a large amount on the component side) is left unbroken to act as a shield from the circuit below and to provide low inductance ground paths. The unbroken area is connected to ground potential.

Circuit boards are stacked one above the other upon the vertical member which forms an effective shield from the circuit on the adjacent side. This stacking leaves a pair of compartments between each pair of boards isolated from its neighboring compartment by the ground plane on its own reverse side, ground plane on the board above, vertical member, side wall of the compartment, and compartment shield. There are many such compartments within which the circuits are constructed and which give excellent isolation between stages. This type of structure provides a common electrical ground for all cards, serves as a heat sink, and provides mechanical strength.

In building a transmitter by this technique, the number of heavy, large variable components are reduced to a bare minimum of one variable capacitor. Careful measurement and substitution methods taking into account the stray capacitance and lead inductances of components, printed lines, and terminals enable packaging of VHF circuits in the same manner as low frequency circuits. These circuits can be constructed with components out of stock with a minimum of selection and with minor trimming to compensate for gain and phase variations due to device variations. A substantial reduction in the overall size and weight requirements for the transmitter is effected.

### Notes:

1. Persons and organizations concerned with the design, development, and production of high frequency amplifiers and transmitters and communication equipment will be interested in self-shielding printed circuit boards.

(continued overleaf)

2. No further documentation is available. Inquiries may be directed to:

Technology Utilization Officer  
Headquarters  
National Aeronautics and Space  
Administration  
Washington, D.C. 20546  
Reference: B69-10314

**Patent status:**

No patent action is contemplated by NASA.

Source: D. Galvin of  
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under contract to  
NASA Headquarters  
(HQN-10433)